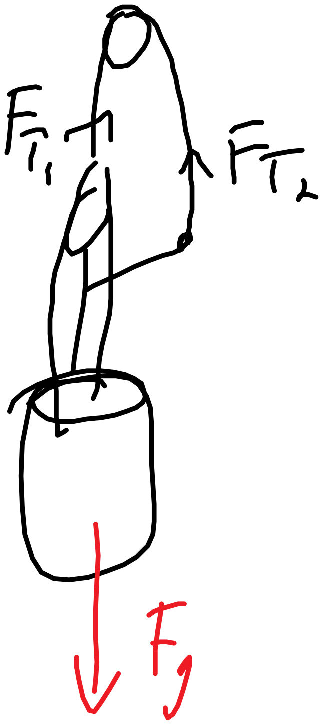
Thursday, October 19, 2017 1:52 PM



$F_T = F_g/2$ $\quad a = 0$

$F_{net} = 2F_T - F_g = ma$

$\cancel{2}\left(1.1 \times \frac{F_g}{\cancel{2}}\right) - F_g = ma$

$1.1\cancel{m}g - \cancel{m}g = \cancel{m}a$

$\boxed{a = 0.1g}$

Circular Motion (not on the test Oct 26th)

Demonstration:
Swing the bucket over my head and the water doesn't fall out.

What's the deal?
2 minutes write a guestimate/explanation

Aswin - the inertia of the water tends to keep it moving in a straight line.
gravity accelerates the water down
If it is moving fast enough, the deflection of the trajectory by gravity matches a circular path.

Let's derive:

Look at a mass m, moving at speed, v, in uniform circular motion (constant speed).
Not constant velocity - the direction is constantly changeing.

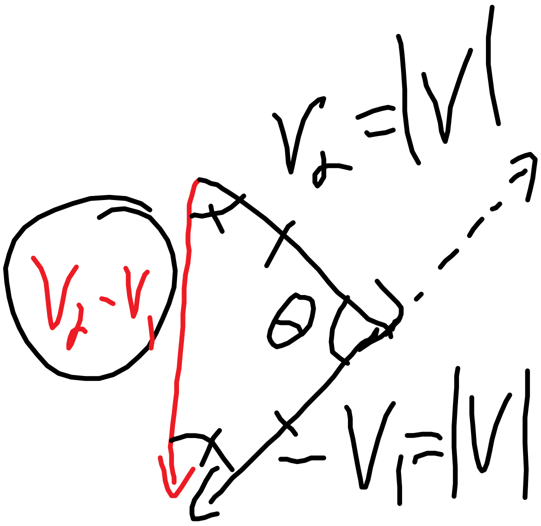
arc length = Δl

arc length = Δx

radius of circular path = r

$$a = \frac{\Delta V}{\Delta t} = \frac{V_2 - V_1}{t}$$

Vector



Kinda like similar triangles

ratio of sides $\dfrac{V_2 - V_1}{V} = \dfrac{\Delta l}{r}$

$$a = \frac{V_2 - V_1}{t} = \frac{\Delta l \, V}{r t}$$

$$\frac{\Delta l}{t} = V$$

valid for

$$\boxed{a = \frac{v^2}{r}}$$

valid for uniform circular motion

What if the circular motion is not uniform?

The same but instead of being the acceleration, it is the centripetal component of the acceleration a_c (towards the centre of the circle).
The tangental component of the acceleration, a_t, give the change in speed.

$$\boxed{a_c = v^2/r}$$

For uniform circular motion, there is no tangental acceleration, the only acceleration is centripetal.

So $F_{net}=ma = ma_c = mv^2/r$ for uniform circular motion.

for non-uniform circular motion,

F_c is the centripetal force, the component of the net force towards the centre of the circle.

circle.

$\boxed{F_c=mv^2/r}$

eg. A skateboarder, mass 80.0 kg wants to do a loop in a big tube. If his centre of mass moves through a circular path of radius 2.0m,

a) what is the minimum speed at the top to make the loop?

a=g

$v^2/r = g$

v = root (gr)

v = Sqrt(9.81x2)=4.42944691807002

v= $\boxed{4.4 m/s}$

a) If there is no energy lost to friction, what is his speed at the bottom?

top = bottom

gravitational and kinetic energy = E_k

$2\,\cancel{m}gh+1/\cancel{2}\cancel{m}v_{top}^2 = 1/\cancel{2}\cancel{m}v_{bottom}^2$

v = Sqrt((2x9.81x4)+(4.4294x4.4294))=

9.904523429221621

$\boxed{9.9 m/s}$

a) What is his acceleration at the bottom?

a= v^2/r = (9.90x9.90)/2=49.005 =49m/s^2

(rather big)

a) what is the normal force on his feet (apprx) at the bottom?

$F_{net} = R - F_g$
$R = F_{net} + Fg$
$= 80kg x 49m/s^2 + 80kg \times 9.81m/s^2$
$= 80x(49+9.81)=4,704.8$
4.7 kN wow! that's a lot!

he doesn't go a full 2m and he bends his knees to minimize this

study for the test:
SHM, vectors, projectiles, Dynamics
(ch11, ch 3, ch 4)